

WHAT IS CLAIMED IS:

1. An apparatus for a Fischer-Tropsch process comprising: a gas inlet, for conducting an inlet gas stream, and at least one product outlet with a reactor there between including a Fischer-Tropsch catalyst, the reactor operable at
5 temperatures of from 175° to 325°C, and a pressure from 1 to 20 atmospheres, and a material, included within the inlet gas stream and upstream from the catalyst, capable of binding sulfur contained in the inlet gas stream.
2. The apparatus according to Claim 1 wherein the material is within the reactor and upstream from the catalyst.
- 10 3. The apparatus according to Claim 1 wherein the material is located within a section of the gas inlet contacting the reactor.
4. The apparatus according to Claim 2 wherein the Fischer-Tropsch catalyst is located in a plurality of catalyst beds, the catalyst bed adjacent to the gas inlet includes the material capable of binding trace amounts of sulfur in the inlet gas.
- 15 5. The apparatus according to Claim 4 wherein the catalyst in said catalyst bed adjacent to the gas inlet is a sacrificial Fischer-Tropsch catalyst.
6. The apparatus according to Claim 1 wherein the sulfur binding material is capable of catalyzing the Fischer-Tropsch reaction at an weight based conversion level less than 80% of the Fischer-Tropsch catalyst of claim 1.
- 20 7. The apparatus according to Claim 1 wherein the sulfur binding material is capable of catalyzing the Fischer-Tropsch reaction at an weight based conversion level less than 60% of the Fischer-Tropsch catalyst of claim 1.
8. The apparatus according to Claim 1 wherein the sulfur binding material is capable of catalyzing the Fischer-Tropsch reaction at an weight based
25 conversion level less than 40% of the Fischer-Tropsch catalyst of claim 1.
9. The apparatus according to Claim 1 wherein the sulfur binding materials is a sacrificial Fischer-Tropsch catalyst selected from the group consisting of Fischer-Tropsch catalysts having a negligible platinum group metal content,

Fischer-Tropsch catalysts having a negligible cobalt content, substantially deactivated Fischer-Tropsch catalysts and mixtures thereof.

10. The apparatus according to claim 9 wherein the sulfur binding material is a Fischer-Tropsch catalyst which contains less than 10% cobalt.
- 5 11. The apparatus according to Claim 9 wherein the Fischer-Tropsch reactor includes an iron-based catalyst adjacent to the inlet, and upstream of a cobalt-based catalyst.
12. The apparatus according to Claim 11 wherein the gas is capable of passing through at least two separate iron-based catalyst beds, said beds alternating
10 between sulfur removal and catalyst changeout.
13. The apparatus according to Claim 1 including means for removing the sulfur binding material when its performance is diminished and replacing it with fresh sulfur binding material.
14. The apparatus according to Claim 1 wherein the sulfur binding materials are
15 present in the form of particles that have a higher settling velocity than the Fischer-Tropsch catalyst wherein said sulfur binding materials preferentially reside near the gas inlet.
15. The apparatus according to Claim 14 further including a means for separating the Fischer-Tropsch catalyst while retaining the sulfur binding material.
- 20 16. The apparatus according to Claim 15 wherein the means for separation is selected from the group consisting of a screen, gravity settling apparatus, a hydrocyclone, a magnetic separator, a fluidized apparatus and combinations thereof.
17. The apparatus according to Claim 1 wherein the sulfur binding material
25 comprises an element or compound of an element selected from the group consisting of Co, Fe, Mo, W, Zn, Ni, V, Cd, Re, Mn, Pb, Ag, As, Cr, Sb, and mixtures thereof.
18. A process for removing sulfur from a synthesis gas in a Fischer-Tropsch reactor that includes:

- i) a gas inlet for conducting an inlet gas stream,
- ii) at least one product outlet, and
- iii) a Fischer-Tropsch catalyst;

the process comprising:

- 5 a) placing a material capable of binding sulfur within the inlet gas stream and upstream from the catalyst; and
- b) passing a sulfur-containing synthesis gas over the material for removing at least a portion of the sulfur contained in the synthesis gas prior to introducing the synthesis gas to the Fischer-Tropsch catalyst.

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